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Epitome

(57) [Abstract]
[Technical problem] The electric disk brake which enables it to compensate wear of a brake friction pad, has it, and contributes to the miniaturization of cost reduction and a caliper greatly is offered without using rotation of a motor.
[Means for Solution] Carry out movement conversion of the rotation of Rota 20 of an electric motor 11 according to the ball lamp device 12. In the electric disk brake which tells a piston 10 and generates damping force The pad wear compensation device 13 is arranged between the direct-acting member 29 of the ball lamp device 12, and a piston 10. Where a motion of a piston is regulated using resistance of the elastic seal 37 infixed between fixed part 5c of the caliper body 5, and a piston 10 Make oil flow between two oil sacs 39 formed in the piston 10, and 40, and it is made to retreat the direct-acting member 29 by pad wear to a piston 10 and relativity. At the time of braking An oil flow between two oil sacs 39 and 40 is regulated by the check valve 43, and a piston 10 is advanced to the direct-acting member 29 and one.

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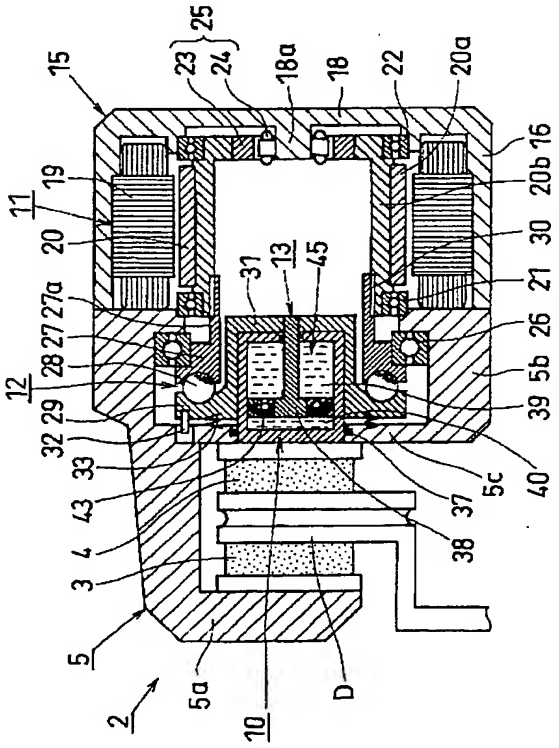

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CLAIMS

[Claim(s)]
[Claim 1] Piston The ball lamp device which changes rotation of an electric motor and this electric motor into rectilinear motion, and is transmitted to said piston Although it is the electric disk brake equipped with the above and relative displacement with the direct-acting member of the ball lamp device at the time of braking and said piston regulates said pad wear compensation device, relative displacement with said direct-acting member at the time of braking discharge and said piston the movement means of communication permit, and always serves as resistance of migration of said piston, and it carries out having constituted from an energization means apply the force of the direction of return to this piston according to promotion of said piston as the description.
[Claim 2] two oil sacs where a movement means of communication enclosed oil -- this -- the electric disk brake according to claim 1 characterized by consisting of an oil pressure device equipped with the check valve which permits only a flow of the oil to the one direction between two oil sacs, and permitting relative displacement with the direct-acting member of a ball lamp device, and a piston according to a flow of the oil between said two oil sacs.
[Claim 3] The electric disk brake according to claim 1 characterized by for a movement means of communication consisting of an engagement device in which a pawl gears with a cutting edge, and permitting relative displacement with the direct-acting member of a ball lamp device, and a piston according to discharge of engagement of this engagement device.
[Claim 4] An electric disk brake given in claim 1 characterized by for an energization means consisting of an elastic body and being infixed between the fixed part in a caliper, and a piston thru/or any 1 term of 3.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]
[Field of the Invention] This invention relates to the electric disk brake which generates damping force by the torque of an electric motor.
[0002]
[Description of the Prior Art] It has the caliper which has the ball lamp device which changes rotation of a piston, an electric motor, and said electric motor into rectilinear motion, and is transmitted to said piston as this kind of an electric disk brake, a piston is promoted according to rotation of Rota of said electric motor, and there is a thing presses a brake friction pad to a disk rotor, and it was made to generate damping force. And a sensor detects the brake-pedal treading strength (or a variation rate amount) by the operator, and according to this detection, he controls rotation of an electric motor by the controller, and is trying to acquire desired damping force by it by such electric disk brakes.
[0003] By the way, in this kind of electric disk brake, since in addition to the movement magnitude of the direct-acting member of a ball lamp device being restricted it is controlled so that the return location (return include angle) of Rota of an electric motor becomes fixed, the pad wear compensation device in which a piston location is changed according to wear of a brake friction pad is needed. And as such a pad wear compensation device, the thing of a publication was in JP,2000-145843,A conventionally, for example. While this thing combines the direct-acting member and piston of a ball lamp device by the thread part Said direct-acting member, and a piston and a motor rotor A spring, an one way clutch, Actuation connection was mutually carried out according to the movement transfer device equipped with the rotation member, the pin, etc., rotation exceeding the predetermined range of the motor rotor at the time of braking was told to the piston through said movement transfer device at the time of braking discharge, and it had become the structure of making this piston spiraling to said direct-acting member.
[0004]
[Problem(s) to be Solved by the Invention] However, according to the above-mentioned conventional pad wear compensation device, the movement transfer device had many about [that structure is complicated] or components mark, and since the assembly became troublesome, it had the problem that a cost burden was large. Moreover, the movement transfer device occupied the comparatively big tooth space, and the problem that the shaft-orientations die length of a caliper became large was also between the piston and the motor rotor.
[0005] This invention is made in view of the above-mentioned trouble, and the place made into the technical problem is to offer the electric disk brake which enables it to compensate wear of a brake friction pad, has it, and contributes to the miniaturization of cost reduction and a caliper greatly, without using rotation of a motor.

[0006]
[Means for Solving the Problem] In the electric disk brake of the above-mentioned class in which this invention prepared the pad wear compensation device in which a piston location was changed according to wear of a brake friction pad in order to solve the above-mentioned technical problem Although relative displacement with the direct-acting member of the ball lamp device at the time of braking and said piston regulates said pad wear compensation device Relative displacement with said direct-acting member at the time of braking discharge and said piston the movement means of communication to permit and always serves as resistance of migration of said piston, and it is characterized by constituting from an energization means to apply the force of the direction of return to this piston according to promotion of said piston. Thus, in the constituted electric disk brake, if the brake friction pad is worn out, an energization means will be resisting at the time of braking discharge, the direct-acting member of a ball lamp device will be displaced relatively with a piston through a movement means of communication, and a piston location will be changed automatically. A deer is carried out, and since the movement means of communication which constitutes a pad wear compensation device serves as actuation of only the direction of direct-acting regardless of rotation of a motor rotor, simplification of structure can be attained.
[0007] two oil sacs where the above-mentioned movement means of communication enclosed oil in this invention -- this -- it consists of an oil pressure device equipped with the check valve which permits only a flow of the oil to the one direction between two oil sacs, and can consider as the configuration with which relative displacement with the direct-acting member of a ball lamp device and a piston is permitted according to a flow of the oil between said two oil sacs. Moreover, this movement means of communication consists of

an engagement device in which a pawl gears with a cutting edge, and can be considered as the configuration with which relative displacement with the direct-acting member of a ball lamp device and a piston is permitted according to discharge of engagement of this engagement device. Furthermore, the above-mentioned energization means is good also as a configuration infixed between the fixed part in a caliper, and a piston by an energization means consisting of an elastic body.

[0008]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained to a detail based on a drawing.

[0009] Drawing 1 thru/or drawing 4 show the gestalt of operation of the 1st of the electric disk brake concerning this invention. In these drawings, the caliper by which the carrier fixed to the nonrotation sections (knuckle etc.) of the car with which 1 is located in the car inside from the disk rotor D, and 2 were supported by the carrier 1 possible [floating to the shaft orientations of the disk rotor D], and 3 and 4 are the brake friction pads of the pair arranged at the both sides of the disk rotor D, and brake friction pads 3 and 4 are supported by the shaft orientations of the disk rotor D movable at the carrier 1. The caliper 2 is equipped with the caliper body 5 which has ******** 5c which it has claw part 5a in a tip side, and it has tubed part 5b in a end face side, respectively, and separates claw part 5a and tubed part 5b. It is combined with a carrier 1 possible [sliding] through the slide pin 6 of two right and left, and this caliper body 5 is arranged in that claw part 5a and tubed part 5b by this integrated state at the both sides of the disk rotor D, and is located in the outside of said brake friction pads 3 and 4. In addition, the exposed part of a slide pin 6 is covered with the boot 7.

[0010] The caliper 2 is equipped with the ball lamp device 12 which changes into rectilinear motion rotation of the piston 10 which can contact the tooth back of the brake friction pad (this is hereafter called inner pad) 4 of the car inside, an electric motor 11, and this electric motor, and is told to said piston 10, and the pad wear compensation device 13 in which the location of a piston 10 is changed according to wear of the inner pad 4.

[0011] The electric motor 11 is dedicated in the motor case 15 which used the bolt 14 for the back end of tubed part 5b of the caliper body 5, and was connected with it. The motor case 15 consists of covering 18 fixed to the back end of the approximately cylindrical case body 16 and the case body 16 by using a bolt 17, and fitting maintenance of the stator 19 of an electric motor 11 is carried out at the case body 16. Rota (henceforth a motor rotor) 20 of an electric motor 11 consists of base material 20b of the shape of a cylinder which supports cylinder-like magnet object 20a and this magnet object 20a, is carrying out fitting to the bearing 21 which equipped with the both ends of that base material 20b in tubed part 5b of said caliper body 5, and the bearing 22 with which the covering 18 of the motor case 15 was equipped, and is arranged rotatable in the motor case 15. An electric motor 11 operates by the command from a controller (not shown), and the angle of rotation of the motor rotor 20 is detected by the rotation detector 25 which consists of a rotator 23 prepared in the motor rotor 20, and a stator 24 prepared in central boss section 18a of the covering 18 of the motor case 15. In addition, it is in the motor case 15. Although the signal line which connects the stator 19 and the rotation detector 25, and said controller of an electric motor 11 is managed, illustration is omitted about these.

[0012] The outline configuration of the ball lamp device 12 is carried out from the rotation member 27 of the shape of a circular ring supported rotatable through bearing 26 in tubed part 5b of the caliper body 5, and the direct-acting member 29 by which the polymerization was carried out to this rotation member 27 through the ball 28 at shaft orientations. The rotation member 27 has tubed part 27a prolonged in the motor case 15, and rotates it to this motor rotor 20 and one by combining this tubed part 27a with said motor rotor 20 through the spline section 30. On the other hand, the direct-acting member 29 has the cylinder part 31 of the owner bottom which carries out opening in the central site at the inner pad 4 side, and said piston 10 is contained by the cylinder part 31. Moreover, the pin 32 and the elastic body 33 are infixed between the direct-acting member 29 and the caliper body 5 including said septum section 5c, and the baffle of the direct-acting member 29 is carried out by said pin 32, and it is always energized with said elastic body 33 to the rotation member 27 side.

[0013] Here, the ball 28 which constitutes the ball lamp device 12 is arranged in three ball slots 34 formed in the opposed face of the rotation member 27 and the direct-acting member 29 in the shape of radii along with the circumferencial direction, respectively, and 35. Each ball slots 34 and 35 incline in this direction, respectively, and it is the range of an equal central angle (for example, 90 degrees), and is arranged at equal

intervals, and three balls 28 roll the inside of the ball slot 34 and 35 by rotation of the rotation member 27 to the direct-acting member 29. When the rotation member 27 sees from the right of drawing 1 and rotates clockwise to the direct-acting member 29, the ball slots 34 and 35 are formed so that the direct-acting member 29 may move forward leftward [of this drawing] (straight-line migration). On the other hand, if the rotation member 27 rotates counterclockwise to the direct-acting member 29 from this condition that advanced, the direct-acting member 29 will be pushed on a spring (elastic body) 33, and will retreat rightward [of drawing 1].

[0014] The piston 10 has hollow structure here and the point is inserted in the through tube 36 prepared in septum section 5c of said caliper body 5. Circular-sulcus 36a is formed in the inner circumference of said through tube 36, and the elastic ring 37 made of rubber (energization means) which ****s to the peripheral face of a piston 10 is contained in this circular-sulcus 36a. Although this elastic ring 37 functions as resisting migration of a piston 10, in case a piston 10 moves forward compulsorily (promotion), as an alternate long and short dash line shows (drawing 2), elastic deformation of it is carried out and it always applies the force of the retreat direction (the return direction) to a piston 10. In addition, this elastic ring 37 constitutes said pad wear compensation device 13.

[0015] Two oil sacs 39 and 40 are formed by the oil pressure piston 38 in the piston 10. The oil pressure piston 38 is formed at the tip of the rod 41 which inserted in back end wall 10a of a piston 10, and was extended from the bottom of the cylinder part 31 of the direct-acting member 29 which constitutes said ball lamp device 12, and is united with the direct-acting member 29. The oil pressure piston 38 and a piston 10 **** through the seal member 42, and both relative displacement is attained. A deer is carried out, oil is enclosed in said two oil sacs 39 and 40, and, on the other hand, two or more check valves 43 which permit only a flow of the oil from the oil sac 39 to the front oil sac 40 of the back located in a rod 41 side are formed in the oil pressure piston 38. In addition, the seal member 44 is formed also between the piston 10 and the rod 41, and, thereby, the liquid spill from a piston 10 is prevented.

[0016] The oil sacs 39 and 40 of 38 or 2 oil pressure pistons in the above-mentioned piston 10, the rod 41, and the check valve 43 grade constitute the oil pressure device 45 in which it is used as a movement transfer device of said pad wear compensation device 13. In this oil pressure device 45, at the time of advance of the direct-acting member 29, since oil flows between two oil sacs 39 and 40 through a check valve 43 when a piston 10 moves forward to the direct-acting member 29 and one (promotion) and the force of the retreat direction acts on the direct-acting member 29 on the other hand, since oil is confined in the front oil sac 40 by the check valve 43, relative displacement with a piston 10 and the direct-acting member 29 is permitted.

[0017] Hereafter, drawing 5 and drawing 6 are also explained with reference to an operation of the operation gestalt of the above 1st. At the time of braking, the motor rotor 20 rotates clockwise according to the signal from a controller (not shown). Then, the rotation member 27 which constitutes the ball lamp device 12 in this motor rotor 20 and one rotates, the ball 28 of the ball lamp device 12 rolls along the ball slots 34 and 35, and the direct-acting member 29 moves forward. And advance of the direct-acting member 29 also advances the oil pressure piston 38 connected with this with the rod 41. At this time, it will be in the condition that oil is confined in the front oil sac 40 by the check valve 43, a piston 10 moves forward to the direct-acting member 29 and one by this (promotion), and the inner pad 4 is pushed against the disk rotor D. Then, a caliper 2 retreats by counteraction of this forcing, claw part 5a of the caliper body 5 pushes the outside brake friction pad 3 against the disk rotor D, and, thereby, the damping force according to the torque of an electric motor 11 occurs. In addition, at the time of this braking, the elastic ring 37 carries out elastic deformation according to advance of a piston 10, and the force of the return direction is applied to a piston 10.

[0018] On the other hand, at the time of braking discharge, the motor rotor 20 rotates counterclockwise, the ball 28 of the ball lamp device 12 rolls to the time of braking, and hard flow along the ball slots 34 and 35, and the force in which this promotes a piston 10 from the direct-acting member 29 is lost. Then, a piston 10 retreats from the stability of the elastic deformation of the elastic ring 37, and returns to the location of the origin which forms the predetermined path clearance (pad path clearance) (refer to drawing 6) delta between the inner pads 4. Moreover, the direct-acting member 29 also retreats according to the force of a spring 33 to this and coincidence, and the ball lamp device 12 returns to the original condition at them.

[0019] By the way, wear of brake friction pads 3 and 4 forms the gap which applied the pad abrasion loss delta to the pad path clearance delta between the pistons 10 and the inner pads 4 which returned to the original location as shown in drawing 5 **. And if the motor rotor 20 rotates clockwise in order to perform braking

from this condition, the direct-acting member 29 of the ball lamp device 12 will move forward, and a piston 10 will move forward to this and one. Under the present circumstances, a piston 10 moves forward by the pad path clearance delta, carrying out elastic deformation of the elastic ring 37 first, moves forward by the pad abrasion loss delta, and pushes (**) and this inner pad 4 against the disk rotor D in contact with the inner pad 4, sliding on the (**), then elastic ring 37 top, and, thereby, damping force generates it.

[0020] On the other hand, if the motor rotor 20 rotates counterclockwise from this condition that braking should be canceled, as shown in drawing 6 **, a piston 10 will retreat by the pad path clearance delta according to the stability of the elastic deformation of the elastic ring 37, and the direct-acting member 29 will also retreat according to the force of a spring 33 to this and coincidence. A deer is carried out, and by existence of said pad abrasion loss delta, since the motor rotor 20 is rotating more than an include angle usually required for braking at the time of braking, if the motor rotor 20 rotates to the original location (angle of rotation), the direct-acting member 29 will retreat further to an initial valve position. Since location immobilization of the piston 10 is carried out by resistance of the elastic ring 37 at this time, the oil pressure in the back oil sac 39 increases according to the force of joining the oil pressure piston 38 from the direct-acting member 29, as shown in drawing 6 **, the oil in this oil sac 39 flows to the front oil sac 40 through a check valve 43, and the direct-acting member 29 which contains a cylinder part 31 by this is displaced relatively with a piston 10. Consequently, the location (appearance cost) of the piston 10 to a cylinder part 31 is changed, and the predetermined pad path clearance delta is maintained between a piston 10 and the inner pad 4. Namely, it will be in the condition that pad wear was compensated.

[0021] Drawing 7 shows the gestalt of operation of the 2nd of the electric disk brake concerning this invention. In addition, since the basic configuration of the oil pressure device 45 which constitutes the overall configuration of this electric disk brake and the pad wear compensation device 13 is the same as the gestalt of implementation of the above 1st, it gives the same sign to the same component as what was shown in said drawing 1 -4 here. While forming the back oil sac 39 between two oil sacs which constitute the oil pressure device 45 between the bottom of the cylinder part 31 of the direct-acting member 29, and back end wall 10a of a piston 10, the place by which it is characterized [of the gestalt of operation of **** 2] It is in the point of having formed the check valve 43 which formed the front oil sac 40 between back end wall 10a of the oil pressure piston 38 in a piston 10, and a piston 10, and had established it in the oil pressure piston 38 with the gestalt of the 1st operation further in back end wall 10a of a piston 10. However, with the gestalt of the 1st operation, the check valve 43 is arranged so that only a flow of the oil from the oil sac 40 to the back oil sac 39 of the reverse sense, i.e., the front, may be permitted.

[0022] The overall operation of the gestalt of implementation of the above 2nd is the same as that of the gestalt of implementation of the above 1st, and at the time of braking, it is that the motor rotor 20 rotates clockwise, and the direct-acting member 29 which constitutes the ball lamp device 12 moves forward, and it will be in the condition that oil is confined in the back oil sac 39 by the check valve 43, at this time. Thereby, in the direct-acting member 29 and one, a piston 10 moves forward, carrying out elastic deformation of the elastic seal 35 (promotion), and pushes the inner pad 4 against the disk rotor D, and damping force occurs. On the other hand, at the time of braking discharge, by rotation of the counterclockwise rotation of the motor rotor 20, the direct-acting member 29 also retreats according to the force of a spring 33, and the ball lamp device 12 and the motor rotor 20 return to the original condition (or location) at the same time a piston 10 retreats from the stability of the elastic deformation of the elastic ring 37.

[0023] In this case, wear of brake friction pads 3 and 4 forms the gap which applied the pad abrasion loss delta to the pad path clearance delta between the pistons 10 and the inner pads 4 which returned to the original location, as shown in drawing 8 **. And if the motor rotor 20 rotates clockwise in order to perform braking from this condition, the ball lamp device 12 will operate and a piston 10 will move forward to that direct-acting member 29 and one. Under the present circumstances, as shown in drawing 8 ** and **, a piston 10 moves forward by the pad path clearance delta, carrying out elastic deformation of the elastic ring 37 first, it moves forward by the pad abrasion loss delta, and pushes (**) and this inner pad 4 against the disk rotor D in contact with the inner pad 4, sliding on the (**), then elastic ring 37 top, and, thereby, damping force generates it.

[0024] On the other hand, if the motor rotor 20 rotates counterclockwise from this condition that braking should be canceled, as shown in drawing 9 **, a piston 10 will retreat by the pad path clearance delta according to the stability of the elastic deformation of the elastic ring 37, and the direct-acting member 29 will also retreat according to the force of a spring 33 to this and coincidence. A deer is carried out, and by

existence of said pad abrasion loss delta, since it is rotating more than the include angle which needs the motor rotor 20 for the usual braking at the time of braking, if the motor rotor 20 rotates to the original location (angle of rotation), the direct-acting member 29 will retreat further to an initial valve position. Since location immobilization of the piston 10 is carried out by resistance of the elastic ring 37 at this time, the oil pressure in the front oil sac 40 increases according to the force of joining the oil pressure piston 38 from the direct-acting member 29, as shown in drawing 9 **, the oil in this oil sac 40 flows to the back oil sac 39 through a check valve 43, and the direct-acting member 29 which contains a cylinder part 31 by this is displaced relatively with a piston 10. Consequently, the location (appearance cost) of the piston 10 to a cylinder part 31 is changed, and the predetermined pad path clearance delta is maintained between a piston 10 and the inner pad 4. Namely, it will be in the condition that pad wear was compensated.

[0025] In the gestalt of the above-mentioned 1st and the 2nd operation, since the oil pressure device 45 is used as a movement means of communication which constitutes the pad wear compensation device 13, pad wear can be compensated with actuation of only the direction of direct-acting regardless of rotation of the motor rotor 20, and the structure becomes comparatively easy. Moreover, the subassembly of this oil pressure device 45 is carried out, and since unitization can be carried out, assembly nature improves remarkably. Moreover, as an energization means to apply the force of the direction of return for always becoming resistance of migration of said piston 10, and promotion of a piston 10 responding, since the elastic ring 37 of a single member is used, thereby, structure does not become complicated.

[0026] Drawing 10 and drawing 11 show the gestalt of operation of the 3rd of the electric disk brake concerning this invention. In addition, since the configuration of those other than pad wear compensation device 13 is the same as the gestalt of implementation of the above 1st, this electric disk brake gives the same sign to the thing same component shown in said drawing 1 -4. In the gestalt of operation of **** 3, forward/backward moving of the piston 10 arranged in the cylinder part 31 of the direct-acting member 29 is carried out along with the disc-like guide member 52 prepared at the tip of the rod 51 extended from central boss section 18a of the covering 18 of the motor case 15. Circular-sulcus 52a is formed in the periphery of the guide member 52, and the elastic ring 53 made of rubber (energization means) which ****s to the peripheral face of a piston 10 is contained by this circular-sulcus 52a. Although this elastic ring 53 functions as resisting migration of a piston 10, in case a piston 10 moves forward compulsorily (promotion), as an alternate long and short dash line shows (drawing 11), elastic deformation of it is carried out and it always applies the force of the retreat direction (the return direction) to a piston 10. This elastic ring 53 constitutes said pad wear compensation device 13.

[0027] Moreover, it arranges in the shape of a saw blade to the shaft orientations, and two or more cutting edges 54 allot [circumferencial direction], two or more trains (here four trains) formation is carried out, and, on the other hand, two or more pawls 55 which can be geared are attached in the cutting edge 54 of each of said train rockable to the inside of the cylinder part 31 of the direct-acting member 29 at the peripheral face of a piston 10 using the pin 56. If a pawl 55 gears with a cutting edge 54 when the direct-acting member 29 moves forward, therefore the direct-acting member 29 moves forward, a piston 10 will also come to move forward to this and one. These cutting edges 54 and a pawl 55 constitute the engagement device 57 in which it is used as said pad wear compensation device 13. In addition, between septum section 5c of the caliper body 5, and a piston 10, the seal 58 which prevents invasion of the moisture by the side of the engagement device 57 etc. is stretched.

[0028] Hereafter, drawing 12 and drawing 13 are also explained with reference to an operation of the operation gestalt of the above 3rd. At the time of braking, if the motor rotor 20 rotates clockwise according to the signal from a controller (not shown), the rotation member 27 which constitutes the ball lamp device 12 will rotate, the ball 28 of the ball lamp device 12 will roll along the ball slots 34 and 35, and the direct-acting member 29 will move forward. And if the direct-acting member 29 moves forward, the pawl 55 by the side of the direct-acting member 29 will gear with the cutting edge 54 currently formed in the piston 10, a piston 10 will move forward to the direct-acting member 29 and one (promotion), and the inner pad 4 will be pushed against the disk rotor D. Then, a caliper 2 retreats by counteraction of this forcing, claw part 5a of the caliper body 5 pushes the outside brake friction pad 3 against the disk rotor D, and, thereby, the damping force according to the torque of an electric motor 11 occurs. In addition, at the time of this braking, the elastic ring 53 carries out elastic deformation according to advance of a piston 10, and the force of the return direction is applied to a piston 10.

[0029] On the other hand, at the time of braking discharge, the motor rotor 20 rotates counterclockwise, the ball 28 of the ball lamp device 12 rolls to the time of braking, and hard flow along the ball slots 34 and 35, and the force in which this promotes a piston 10 from the direct-acting member 29 is lost. Then, a piston 10 retreats from the stability of the elastic deformation of the elastic ring 53, and returns to the location of the origin which forms the predetermined path clearance (pad path clearance) (refer to drawing 13) delta between the inner pads 4. Moreover, the direct-acting member 29 also retreats according to the force of a spring 33 to this and coincidence, and the ball lamp device 12 returns to the original condition at them.
[0030] Wear of brake friction pads 3 and 4 forms the gap which applied the pad abrasion loss delta to the pad path clearance delta between the pistons 10 and the inner pads 4 which returned to the original location, as shown in drawing 12 **. And if the motor rotor 20 rotates clockwise in order to perform braking from this condition, the ball lamp device 12 will operate and a piston 10 will move forward to that direct-acting member 29 and one. Under the present circumstances, as shown in drawing 12 ** and **, a piston 10 moves forward by the pad path clearance delta, carrying out elastic deformation of the elastic ring 53 first, it moves forward by the pad abrasion loss delta, and pushes (**) and this inner pad 4 against the disk rotor D in contact with the inner pad 4, sliding on the (**), then elastic ring 53 top, and, thereby, damping force generates it.
[0031] On the other hand, if the motor rotor 20 rotates counterclockwise from this condition that braking should be canceled, as shown in drawing 13 **, a piston 10 will retreat by the pad path clearance delta according to the stability of the elastic deformation of the elastic ring 53, and the direct-acting member 29 will also retreat according to the force of a spring 33 to this and coincidence. A deer is carried out, and by existence of said pad abrasion loss delta, since the motor rotor 20 is rotating more than an include angle usually required for braking at the time of braking, if the motor rotor 20 rotates to the original location (angle of rotation), the direct-acting member 29 will retreat further to an initial valve position. Since location immobilization of the piston 10 is carried out to the guide member 52 by resistance of the elastic ring 53 at this time, as shown in drawing 13 **, the engagement of a pawl 55 to a cutting edge 54 separates, and the direct-acting member 29 is displaced relatively with a piston 10. Consequently, the location (appearance cost) of the piston 10 to a cylinder part 31 is changed, and the predetermined pad path clearance delta is maintained between a piston 10 and the inner pad 4. Namely, it will be in the condition that pad wear was compensated.
[0032] In the gestalt of implementation of the above 3rd, since the cutting edge 44 and the pawl 45 use the engagement device 57 in which it gears mechanically, as a movement means of communication which constitutes the pad wear compensation device 13, the structure becomes easy compared with the gestalt of the 1st which established the oil pressure device 45, and the 2nd operation and maintainability improves, it is advantageous in cost.
[0033] Drawing 14 and drawing 15 show the gestalt of operation of the 4th of the electric disk brake concerning this invention. In addition, since the basic configuration of the engagement device 57 which constitutes the overall configuration of this electric disk brake and the pad wear compensation device 13 is the same as the gestalt of implementation of the above 3rd, it gives the same sign to the same component as said drawing 10 and the thing shown in 11 here. The place by which it is characterized [of the gestalt of operation of **** 4] replaces with the pawl 55 in the gestalt of implementation of the above 3rd the pawl formed in the inside of the cylinder part 31 of the direct-acting member 29, and is in the point used as the elastic pawl 61. The elastic pawl 61 is formed as a compound pawl which arranged **** of plurality (three) here, and is unified by adhesion or joining to the cylinder part 31. As shown in drawing 15 (1), in case the direct-acting member 29 moves forward, this elastic pawl 61 maintains that configuration, gears with the cutting edge 54 by the side of a piston 10, it takes a piston 10, in case the direct-acting member 29 retreats to a piston 10 on the other hand, as it is shown in drawing 15 (2), it carries out elastic deformation, and the engagement to a cutting edge 54 separates from it.
[0034] The overall operation of the gestalt of implementation of the above 4th is the same as that of the gestalt of implementation of the above 3rd. At the time of braking The direct-acting member 29 which constitutes the ball lamp device 12 from the motor rotor 20 rotating clockwise moves forward. At this time, the elastic pawl 61 by the side of the direct-acting member 29 gears with the cutting edge 54 currently formed in the piston 10. In the direct-acting member 29 and one, a piston 10 moves forward, carrying out elastic deformation of the elastic ring 53 (promotion), and pushes the inner pad 4 against the disk rotor D, and, thereby, predetermined damping force occurs. On the other hand, at the time of braking discharge, by rotation

of the counterclockwise rotation of the motor rotor 20, the direct-acting member 29 also retreats according to the force of a spring 33, and the ball lamp device 12 and the motor rotor 20 return to the original condition (or location) at the same time a piston 10 retreats from the stability of the elastic deformation of the elastic ring 53.

[0035] Wear of brake friction pads 3 and 4 forms the gap which applied the pad abrasion loss delta to the pad path clearance delta between the pistons 10 and the inner pads 4 which returned to the original condition, as shown in drawing 16 **. And if the motor rotor 20 rotates clockwise in order to perform braking from this condition, the ball lamp device 12 will operate and a piston 10 will move forward to that direct-acting member 29 and one. Under the present circumstances, as shown in drawing 16 ** and **, a piston 10 moves forward by the pad path clearance delta, carrying out elastic deformation of the elastic ring 53 first, it moves forward by the pad abrasion loss delta, and pushes (**) and this inner pad 4 against the disk rotor D in contact with the inner pad 4, sliding on the (**), then elastic ring 53 top, and, thereby, damping force generates it. In addition, actuation in the meantime is completely the same as the gestalt of the 3rd operation.

[0036] On the other hand, if the motor rotor 20 rotates counterclockwise from this condition that braking should be canceled, as shown in drawing 17 **, a piston 10 will retreat by the pad path clearance delta according to the stability of the elastic deformation of the elastic ring 53, and the direct-acting member 29 will also retreat according to the force of a spring 33 to this and coincidence. A deer is carried out, and by existence of said pad abrasion loss delta, since the motor rotor 20 is rotating more than an include angle usually required for braking at the time of braking, if the motor rotor 20 rotates to the original location (angle of rotation), the direct-acting member 29 will retreat further to an initial valve position. Since location immobilization of the piston 10 is carried out to the guide member 52 by resistance of the elastic ring 53 at this time, as shown in drawing 17 **, the engagement of the elastic pawl 61 to a cutting edge 54 separates, and the direct-acting member 29 is displaced relatively with a piston 10. Consequently, the location (appearance cost) of the piston 10 to a cylinder part 31 is changed, and the predetermined pad path clearance delta is maintained between a piston 10 and the inner pad 4. Namely, it will be in the condition that pad wear was compensated. In the gestalt of this 4th operation, since the direct-acting member 29 and a piston 10 are made displaced relatively using the elastic deformation of the elastic pawl 61 which gears with the cutting edge 54 by the side of a piston 10, the trouble which attaches a pawl 55 in the direct-acting member 29 using a pin 56 is lost like the gestalt of implementation of the above 3rd, and it becomes more [in cost] advantageous compared with the gestalt of the 3rd operation.

[0037]

[Effect of the Invention] Since it is considering as the structure where wear of a brake friction pad can be compensated only with a motion of the direction of direct-acting according to the electric disk brake concerning this invention, without using rotation of the motor of the direction of direct-acting for a pad wear compensation device as explained in full detail above, the structure becomes easy and the cost reduction by improvement in assembly nature can be attained. Moreover, since it contributes also to the miniaturization of a caliper, the loading nature to a car also improves.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the sectional view showing the overall structure of the electric disk brake as a gestalt of operation of the 1st of this invention.
[Drawing 2] It is the sectional view showing the important section structure of the gestalt of the 1st operation.

[Drawing 3] It is the top view showing a part of overall structure of the gestalt of the 1st operation as a cross section.
[Drawing 4] It is the side elevation showing the overall structure of the gestalt of the 1st operation.
[Drawing 5] It is the mimetic diagram showing order for pad wear compensation actuation of the gestalt of the 1st operation later on.
[Drawing 6] It is the mimetic diagram showing order for pad wear compensation actuation of the gestalt of the 1st operation later on.
[Drawing 7] It is the sectional view showing the important section structure of the electric disk brake as a gestalt of operation of the 2nd of this invention.
[Drawing 8] It is the mimetic diagram showing order for pad wear compensation actuation of the gestalt of the 2nd operation later on.
[Drawing 9] It is the mimetic diagram showing order for pad wear compensation actuation of the gestalt of the 2nd operation later on.
[Drawing 10] It is the sectional view showing the overall structure of the electric disk brake as a gestalt of operation of the 3rd of this invention.
[Drawing 11] It is the sectional view showing the important section structure of the gestalt of the 3rd operation.
[Drawing 12] It is the mimetic diagram showing order for pad wear compensation actuation of the gestalt of the 3rd operation later on.
[Drawing 13] It is the mimetic diagram showing order for pad wear compensation actuation of the gestalt of the 3rd operation later on.
[Drawing 14] It is the sectional view showing the important section structure of the electric disk brake as a gestalt of operation of the 4th of this invention.
[Drawing 15] It is the mimetic diagram showing the operating state of the engagement device of the pad wear compensation device in which it uses with the gestalt of the 4th operation.
[Drawing 16] It is the mimetic diagram showing order for pad wear compensation actuation of the gestalt of the 4th operation later on.
[Drawing 17] It is the mimetic diagram showing order for pad wear compensation actuation of the gestalt of the 4th operation later on.
[Description of Notations]
1 Carrier
2 Caliper
3 Four Brake friction pad
D Disk rotor
5 Caliper Body
5c The septum section of a caliper body (fixed part)
10 Piston
11 Electric Motor
12 Ball Lamp Device
13 Pad Wear Compensation Device
20 Rota of Electric Motor
29 Direct-acting Member of Ball Lamp Device
31 Cylinder Part of Direct-acting Member
37 53 Elastic ring (energization means)
38 Oil Pressure Piston
39 40 Oil sac
43 Check Valve
45 Oil Pressure Device

52 Guide Member
54 Cutting Edge
55 Pawl
61 Elastic Pawl
57 Engagement Device